ISBN: 978-81-968830-0-3

12. Clonal Selection in Crops

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Abstract:

Clonal selection is a vital practice in crop breeding, involving the propagation of elite individuals with desirable traits through asexual reproduction methods like cuttings or tissue culture. This technique ensures the preservation and dissemination of superior genetic characteristics, such as disease resistance, yield potential, and quality attributes, in subsequent generations of crops.

Through clonal selection, farmers and breeders can rapidly multiply and distribute high-performing cultivars, enhancing agricultural productivity and sustainability. Furthermore, it allows for the maintenance of uniformity within crop populations, facilitating efficient management practices. Overall, clonal selection plays a pivotal role in crop improvement efforts, fostering the development of resilient and high-yielding varieties to meet global food demands.

Keywords:

Clonal Selection, High Yielding, Crop Breeding, Resilient Cultivar.

12.1 Definition:

Clone is the single true to type progeny obtained from the propagules of asexually (without undergoing meiosis) reproducing crops. Cloning is the process of producing genetically identical clones from the source mother plants which are vegetatively propagated. They are genetically heterozygous, but phenotypically uniform due to the genetic identity of each clone arising from the vegetative propagation.

12.2 Characteristics of the Clone:

A. Clones are genetically uniform, identical and heterozygous. Phenotypically they are homogeneous and all the progenies are uniform.
B. They are asexually reproducing plants propagated through vegetative propagules like stems, tubers, bulbs and
C. They are phenotypically stable and less influenced by the Genotype X Environment interactions. Variations within the clones are due to the environment.
D. wider adaptations than pureline due to heterozygous vigor of the progenies.
E. Clonal degeneracy: Over a period of time, clones lose their vigour and performances due to biotic and abiotic stresses.

Table 12.1: Comparison of pure line and clone

Sr. No	Characteristics	Pureline	Clone
1.	Pollination	Self-pollinated	Cross pollinated
2.	Genetic constitution	Homozygous and homogeneous	Heterozygous and homogeneous
3.	Quality of produce	Highly uniform	Highly uniform
4.	Genetic uniformity of progenies	Identical	Identical
5.	Selection	Within the pureline is not effective	Within the clone is not effective
6.	Period for release of variety	8-10 years	8-10 years
7.	Adaptation of the variety developed	Narrow	wide

12.3 Clonally Propagated Crops:

a. Sugarcane (Saccharum officinarum)- Stem cuttings
b. Potato (Solanum tuberosum)- Tubers
c. Sweet potato (Ipomea batatas)- Stem cuttings
d. Turmeric (Curcuma longa)- Rhizome
e. Ginger (Zingifer officinale)- Rhizome
f. Cassava/ Tapioca (Manihot esculenta)- Stem cuttings
g. Taro (Colocasia esculenta)- Suckers
h. Yam (Diascorea sp)- Corms and tubers

i. Banana (Musa paradisiaca)- Suckers
j. Mango (Mangifera indica)- Grafts
k. Grapes (Vitis vinifera)- Rooted cuttings

12.4 Genetic Basis of Clonal Selection:

Variations in clones are mainly caused due to mutation and hybridization. Clones can be mixtures of phenotypically / genetically non identical due to presence of mixtures in the populations.

Mixtures can arise due to clonal hybridizations derived clonal progenies, and mutations.

Selecting single progeny from source mother plant and multiplying the genetically identical progenies results in identification of superior clone which can be a new variety of the clonally propagated crop.

E.g. Sugarcane, potato, cassava, onion, and turf grasses clonal selection has the advantage of maintaining the vigor of the progenies to several generations without losing them due segregation. Once the variability is identified from the mixture of clones, the clone can be maintained by vegetative propagation infinitely until there is clonal degeneracy.

12.4.1 History of Clonal Selection:

Clonal selection was one of the primitive methods for identifying elite clones from the mixtures of clones in fruit trees, forage crops, tubers, bulbs and ornamental shrubs. Earlier fruit varieties were evolved through clonal selection both by natural and artificial selection methods. Examples of artificial clonal selection

Pear: Bartlett: 1770

Apple: Delicious: 1870

Grapes: Cabernet Savignon: 2000

potato: Kufri red, Kufri safed

Mango: Ko11 and Ko22 from Neelum variety

Banana: Bombay green, Pride monthan and High gate

Turmeric: Megha-1: Clonal selection from local variety Lakadong

12.4.2 Clonal Selection:

A procedure of selection of superior progeny from the existing mixtures of a population of asexually reproducing crops is known as clonal selection.

A. Steps in Clonal Selection:

a. 250-500 clones of the vegetatively propagated crop should be raised in wider space: **I year**
b. Observations on yield and other related parameters/ traits of interest should be taken and analysed biometrically. **II Year**
c. Identification of better performing clone from the clonal population raised in the initial trials. **III-V years**
d. Multiplication of better performing clone and subjected to initial evaluation trials along with check: **VI-VI years**
e. Stability analysis of better performing clone along with existing check- **VII year**
f. Proposal for variety release after the phenotypic characterization of identified clones- **VIII year**

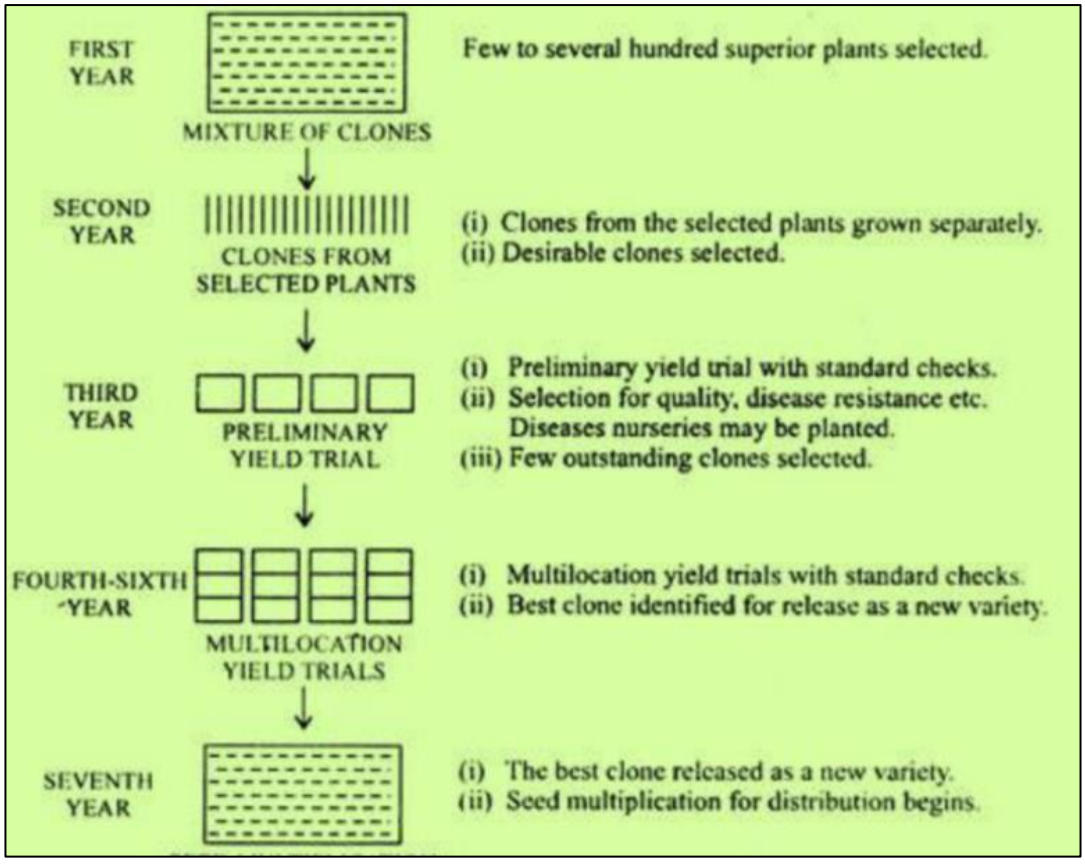

Figure 12.1: Schematic Diagram depicting procedures and time scale of clonal selection in vegetatively propagated crops

B. Advantages of Clonal Selection:

a. Improvement of existing clones for better performance

b. simple and reproducible method of improvement of performance in asexually propagated clones where crossing and generation of fertile progenies is a difficult task eg banana, grapes
c. Multiplication and spread of clones are easier
d. Stability and reliability of performance of clones due to fixation by vegetative reproduction

C. Disadvantages of Clonal Selection:

a. lesser genetic variation presents in the clonal population with little scope of improvement
b. loss of performance/vitality of clones due to clonal degeneracy induced by pests and diseases

12.5 References:

1. Principles of Plant Breeding: Robert W Allard (Second edition)
2. Plant Breeding: Principles and Methods: B D Singh (2022)
3. Evolution of crop Plants. J Smart Norman Simmonds (1995) Second Edition